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A Novel Approach for the Detection & Classification of Diabetic Retinopathy

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Abstract :-When sugar level(glucose) in the blood fails to regulate the insulin properly in human body ,diabetic is occurred. The effect of diabetic on eye causes diabetic retinopathy. Diabetic Retinopathy is one of a complicated diabetes which can cause blindness .It is a metabolic disordered. patients perceive no symptoms until the disease is at late stage. So early detection and proper treatment has to be ensured. To serve this purpose, various automated systems have been designed. There are two levels of diabetic retinopathy which are non proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR).The presence of micro aneurysms in the eye is one of the early signs of diabetic retinopathy. The objectives of this paper are 1) classify different stages of non proliferative diabetic retinopathy (NPDR) as mild NPDR, Moderate NPDR, Severe NPDR. 2)classification of micro aneurysms and exudates.

Keywords:- *classification of NPDR(Mild, Moderate, Severe),exudates, micro aneurysms.*

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1] Introduction

1.1) History

Diabetic retinopathy is non-communicable disease. The world having more than 150 million diabetic patients. World Health Organization projects that diabetes will be the7th leading cause of death in 2030[2]. A person who's blood sugar level is high, unable to produce sufficient insulin so that cells fail to give the correct response for reproducing the insulin level. Diabetes mellitus (DM) consisting three types:-**1)1 DM-** This form referred to as "insulin-dependent diabetes mellitus" (IDDM) or "juvenile diabetes" as per previous theory detection .In this type the body failed to produce insulin, so that the person who requiring it either inject insulin or wear an insulin pump. 2) **2 DM-** This form referred as non insulin-dependent diabetes mellitus (NIDDM) or "adult-onset diabetes. It is a type in which insulin act as a resistance, where cells fail to use insulin properly, combined with an absolute insulin deficiency. **3) 3 DM-**It is occurring of gestational diabetes, That is when pregnant women without a previous diagnosis of diabetes develop a high blood glucose level. It may precede development of type 2 DM.

1.2) Scope of Work:-

The proposed work will help to detect and classified DR diseases accurately. Here to develop the merge techniques for classification of NPDR & PDR .Also calculating the severity by using soft computing tools(MATLAB). It is a time computational techniques.

2] Literature survey & related work :

2.1) In Literature [1] recognizing different stages of Diabetic Retinopathy as NPDR (Non Proliferative Diabetic Retinopathy) and PDR (Proliferative Diabetic Retinopathy). Differentiate it from a normal eye with the study of fundus images. Features can be extracted from these images and fed into the MLP (Multilayer Percept on) for classification and the results have shown an accuracy of 94.11%.

2.2) The objectives of Literature[2] are to (i) detecting blood vessel, (ii) Identifying hemorrhages (iii) classify diabetic retinopathy in different stages as normal, moderate and non proliferative diabetic retinopathy (NPDR).Different stages of diabetic retinopathy can be classify on the basis of detection and quantification of blood vessels and hemorrhages which is present in the retinal image. By utilizing the contrast between the blood vessels and surrounding background, Retinal vascular is segmented**.**

2.3) The Literature[3] has referenced Diabetic retinopathy and Retinitis pigmentosa for analysis purpose. Retinitis pigmentosa is a group of eye related disorders that causes progressive loss of vision. These can be affected the retina having light-sensitive layer tissue at the back of the eye. In people causes by this retinitis pigmentosa losses their vision , because of the light-sensing cells of the retina gradually deteriorate . The first sign of this disorder is a loss of night vision, apparent in childhood . In this study ophthalmologist detected the emergence of its initial symptoms and determine the next immediate action step for the patient by using techniques of Automated approach for detection of micro aneurysms in digital color retinal fundus photographs". The proposed mechanism having the limit of supervised learning so as to automate the practical responses as obtained from the ophthalmologist in real time scenario.

2.4) Non-proliferative DR having exudates as its prominent sign of Both hard and soft exudates which play

a vital role in grading DR into different stages. In Literature[2] presenting an efficient method to identify and classify the exudates as hard and soft exudates. The retinal image in color space is pre-processed for eliminatation of noise. then to facilitate detection and elimination of optic disc, blood vessels network can be used. Optic disc is eliminated using Hough transform technique. Exudates are then detected using k-means clustering technique. Finally, based on edge energy and threshold the exudates are classified as hard and soft exudates. The proposed method has required encouraging results.

2.5) The basic symbols of diabetic retinopathy include micro aneurysms, hemorrhages and exudates. Early diagnosis and timely treatment can be prevented vision loss in patients with long term diabetes. In this Literature[5] used two algorithm based on filtering operations, morphological transformation and region growing method to extract features for detection of micro aneurysms, hemorrhage and color histogram based clustering techniques is used for non linear diffusion segmentation to differentiate hard and soft exudates .

3] Proposed work:

In this proposed work developing such detection techniques which helps to detect and classify the disease at earlier stage in short time duration. Timely detection and treatment for DR prevents severe visual loss in more than 50% of the patients. Also because of shortage of ophthalmologists it helps to detect disease at home. The continuous increase of the diabetic population limit the screening capability for effective timing of sight-saving treatment. Since Automated Techniques that can save time, patient's vision and medical costs.

3.1) Proposed System:

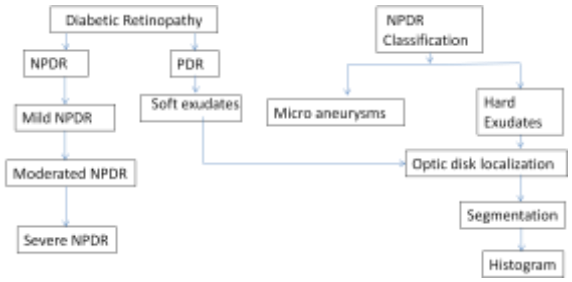

Fig.3.1.1 Flow chart for classification of DR disease and processing methods.

The system can be used for automatic screening of diabetic retinopathy with an additive capability of grading the retinal image on basis of abnormalities present in it and implementing it by using MATLAB tool.

3.2) Process

In detection techniques first GUI represents classification of micro aneurysms and exudates detection .Second GUI presents Micro aneurysms Detection Process as shown in fig.(3.2),where different features included in the micro aneurysms process extracted by using MATLAB tools. The flow of this GUI is used following steps.

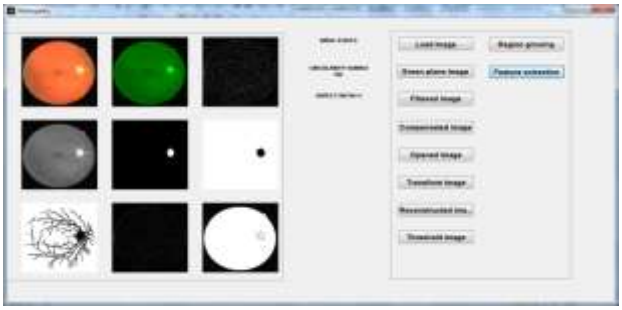

fig.3.1.2 Micro aneurysms Detection Process

Pre-processing

1) Load original image then converted it in to green plane image to reduce the intensity luminance of colour for better result.2)filtrated that image using median filter.3) compensated it by dividing green plan image by filtered image.

After pre-processing apply main functioning like opened image then transform it by using top hat transformation techniques. Reconstruct same image to avoid noise, then thresholding it to convert into binary form. Apply region growing techniques and last features extraction is take place in which area, circularity and aspect ratio are measured.

3.3)Exudates detection techniques

fig.3.1.3 Detection of Exudates

In this optic disk area should be localised by using active counter algorithm to specify iteration level of removing Optic disk. then segmented it and shows the histogram by using multihistogram equalization techniques. Classification is done by using SVM (support vectored machine) classifier.

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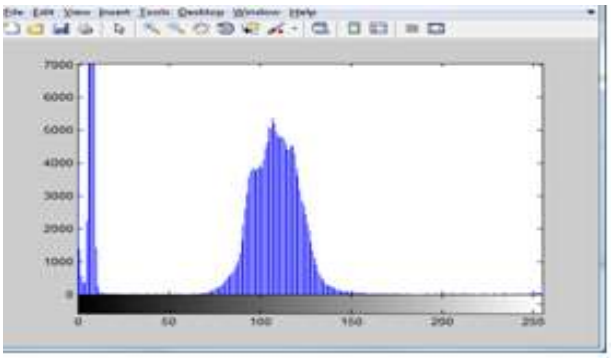

fig.3.1.4 Histogram

3.4) Algorithm

For exudates detection [6] purpose Active Contour-based Segmentation is used also Optic Disk from Retinal Images can detects and removes using principles of mathematical morphology and active contours in a pipeline of routines as shown in fig.3.2.1

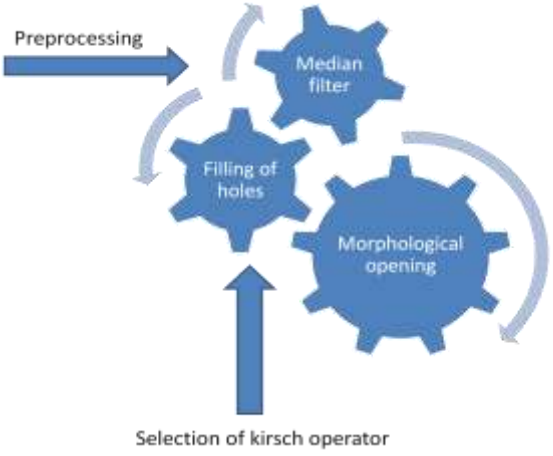

fig.3 .2.1 algorithm for optic disk localization

It gives a computer aided retinal image a system for the segment of optic disk in color digital fundus images using active contours .By Pre-processing the fundus image ,the active contour is initiated where the boundary of the optic disk is initially approximated automatically. This approximation enables placement of initial points of the active contour surrounding the optic disk. Such a mechanism is useful in applications where large number of retinal images in a database need to be processed to remove the optic disk because the automated approximation of the optic disk avoids manual placement of initial control points of the active contour. This algorithm is tested for retinal images containing both soft and hard exudates.

4] **Result**

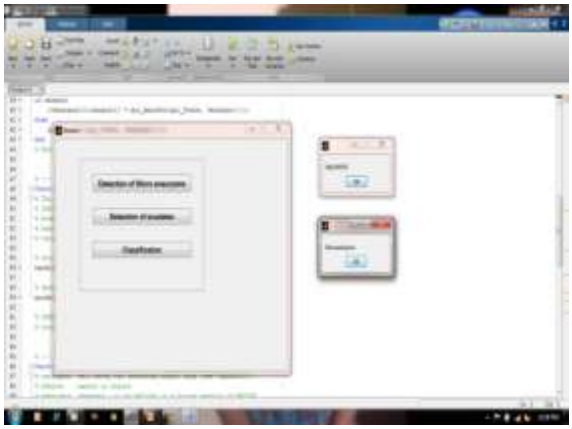

Fig. 4.1 Classification of result

Since In classification ,detects particular disease as whether it is micro aneurysms or exudates and NPDR disease like Mild, severe and moderated. as shown in fig3.1.5.

Total 17 images has been analyzed for the detection purposed. The result found to be mentioned in following table**.**

Image No.	Area (μ+σ)	circularity
2	13453.5	0.00033432
4	9984.125	0.00045049
6	7066	0.00063653
7	18567.25	0.00024224
8	3512.625(minimum)	0.0012804(maximum)
9	15461.375	0.0002909
11	15203.375	0.00029584
12	12770.375	0.0003522
14	22792.125(maximum)	0.00019734(minimum)
16	4932.5	0.00091185

fig.4.2)Mild NPDR-Micro aneurysm

Image No.	Area (μ+σ)	circularity
3	25893.5(maximum)	0.0001737(minimum)
13	8380(minimum)	0.00053672(maximum)
17	11747.75	0.00038286

fig.4.3) Moderated NPDR-Exudates

Image No.	Area (μ+σ)	circularity
1	12663.5	0.00035517
5	9590.25(minimum)	0.00046809(maximum)
10	122211.5	3.680e-0.5
15	17960.5(maximum)	0.00025042(minimum)

fig.4.4) Severe NPDR-Exudates

From above table it is concluded that greater is the cicularity ,area will be lesser and vise versa.also above result shows that mild NPDR occured when microaneurysms is presents.That means it is a initial sign of disease latter on Exudates will be occured with severe or moderated NPDR and PDR detectetion will be last sign of desease.

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